CSMISS IT Seminar Series

"Clockless" Chips and Asynchronous Design: A Radical Approach to Circuit Design

by

Karl M. Fant

Founder and CTO,
Theseus Logic, Inc.
Maitland, FL

Wednesday,
February 13, 2002
12:00 – 1:00 P.M.
167 Conference Room

Offered jointly by
CSMISS and CISM

According to the semiconductor industry, "the design complexity of electronic digital systems is increasing superexponentially". A large portion of this complexity can be found in the methods with which digital systems are expressed. In response, a number of researchers are exploring a radical approach to circuit design, known alternatively as "asynchronous design" or "clockless" chips. Designers are realizing that distributing a clock across ever more complicated systems is becoming more and more difficult, and that dispensing with this overhead confers large advantages on asynchronous or "clockless" chips. The primary advantages are vastly improved electrical efficiency or power management and dramatically reduced noise signature. Other advantages are an edge in computing speed, ease of designability, portability, evolvability, reliability, testability, and fault detection and recovery. Also, because "clockless" chips do not give off regularly timed signals the way clocked circuits do, they can perform encryption in a way that is harder to identify and to crack, thus providing increased security properties. In this talk, Mr. Fant will discuss the benefits and challenges of "clockless" chips and asynchronous design, as well as the derivation of NULL Convention Logic (NCL), a proposed replacement for the conventional system of digital logic. NCL involves "dual-rail" circuits that can send not only bits but also "handshake" signals. Hence, NCL identifies not only "yes" and "no", but also "no answer yet" – a convenient way for clockless chips to recognize when an operation has not yet been completed.

Karl M. Fant is a founder and president of Theseus Research, Inc and a founder and Chief Technology Officer of Theseus Logic, Inc. He received a B.S. in computer science from the University of Minnesota in 1974. He started his career as a research scientist at Honeywell, became a research fellow and received Honeywell's highest technical achievement award before becoming entrepreneurial. He founded Theseus Research in 1990 to pursue applications of ongoing research into the theory of computers. In 1996 he founded Theseus Logic to commercialize NULL Convention Logic which is a direct practical result of the theoretical research. His research interests focus on the nature of process expression in its many forms. His goal is to discover new approaches to designing computer circuits, architectures and languages.

Center for Integrated Space Microsystems — CISM — JPL

CSMISS
Center for Space Mission Information and Software Systems

CSMISS IT Seminar Series:
Highlighting information technology, methodologies, tools, and best practices used in industry and academia.